U.S. ATLAS

Computing Project Management Plan

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List of Abbreviations

ACWP	Actual Cost of Work Performed
ALD	BNL Associate Laboratory Director
APM	Associate Project Manager for Physics and Computing
AY	At Year (referring to a dollar value)
BCP	Baseline Change Proposal
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BHG	Brookhaven Group
BNL	Brookhaven National Laboratory
CB	ATLAS Collaboration Board
CCB	Change Control Board
CERN	European Laboratory for Particle Physics
CH	Chicago Operations Office
DHEP	Division of High Energy Physics
DOE	Department of Energy
EDIA	Engineering Design, Inspection and Assembly
EDMS	Engineering Data Management System
ES&H	Environmental Safety and Health
HEP	DOE Headquarters Office of High Energy Physics
IB	Institutional Board
IMOU	Interim Memorandum of Understanding
JOG	Joint Oversight Group
LHC	Large Hadron Collider
LHCC	CERN LHC Committee
MOU	Memorandum of Understanding
MRE	Major Research Equipment
NSF	National Science Foundation
PAP	Project Advisory Panel
PBS	Product Breakdown Structure
PCAP	Physics and Computing Advisory Panel
PCP	Physics and Computing Project
PL	ATLAS Project Leader
PM	U.S. ATLAS Project Manager
PMCS	Project Management Control System
PMP	Project Management Plan
PO	U.S. ATLAS Project Office
QAP	Quality Assurance Plan
R&D	Research and Development
RRB	ATLAS Resource Review Board
SC	DOE Office of Science
SM	U.S. ATLAS Subsystem Manager
TDR	Technical Design Report
TRT	Transition Radiation Tracker
WBS	Work Breakdown Structure

1. ATLAS Objectives

1.1 Scientific Objectives

The fundamental unanswered problem of elementary particle physics relates to the understanding of the mechanism that generates the masses of the W and Z gauge bosons and of quarks and leptons. To attack this problem, one requires an experiment that can produce a large rate of particle collisions of very high energy. The LHC will collide protons against protons every 25 ns with a center-of-mass energy of 14 TeV and a design luminosity of 10^{34} cm^{-2} s^{-1}. It will probably require a few years after turn-on to reach the full design luminosity.

The detector will have to be capable of reconstructing the interesting final states. It must be designed to fully utilize the high luminosity so that detailed studies of rare phenomena can be carried out. While the primary goal of the experiment is to determine the mechanism of electroweak symmetry breaking via the detection of Higgs bosons, supersymmetric particles or structure in the WW scattering amplitude, the new energy regime will also offer the opportunity to probe for quark substructure or discover new exotic particles. The detector must be sufficiently versatile to detect and identify the final state products of these processes. In particular, it must be capable of reconstructing the momenta and directions of quarks (hadronic jets, tagged by their flavors where possible), electrons, muons, taus, and photons, and be sensitive to energy carried off by weakly interacting particles such as neutrinos that cannot be directly detected. The ATLAS detector is designed to have all of these capabilities.

1.2 Technical Objectives

The ATLAS detector is designed to perform a comprehensive study of the source of electroweak symmetry breaking. It is expected to operate for twenty or more years at the CERN LHC, observing collisions of protons, and recording, reconstructing and analyzing more than 10^7 events per year. The critical objectives to achieve these goals are:

Software and computational hardware capable of reconstructing events in a timely fashion and providing them to the collaboration for physics analysis.
Excellent photon and electron identification capability, as well as energy and directional resolution.
Efficient charged particle track reconstruction and good momentum resolution.
Excellent muon identification capability and momentum resolution.
Well-understood trigger system to go from 1 GHz raw interaction rate to ~100 Hz readout rate without loss of interesting signals.
Hermetic calorimetry coverage to allow accurate measurement of direction and magnitude of energy flow, and excellent reconstruction of missing transverse momentum.
Efficient tagging of b-decays and b-jets.

1.3 Cost Objectives

A revised cost estimate consistent with the agency guidelines is in preparation.

1.4 Schedule Objectives

The major milestones are the May'00 milestone for the first round of prototyping from the Architecture Team, Nov. '00 for a full Project Plan, 2003 for Mock Data Challenges, and 2006 for the start of data taking.

2 ATLAS Organization

2.1 Introduction

The U.S. ATLAS Construction Project operates within the context of the internationally funded ATLAS experiment located at CERN. The general responsibilities of the U.S. participants are described in Article VI of the Experiments Protocol signed between CERN, and DOE and NSF. The responsibilities for the development and maintenance of software and computing hardware is to be described first in a series of Software Agreements, and later on described in a comprehensive MOU between CERN and the relevant funding agencies. The responsibilities of the CERN management are described in Article VIII of the same Protocol.

The U.S. ATLAS Physics and Computing Project is managed by the U.S. ATLAS Project Office, located at Brookhaven National Laboratory (BNL), under the direction of the designated U.S. ATLAS Associate Project Manager for Physics and Computing (hereafter referred to as the Associate Project Manager or APM). The Associate Project Manager has the principal authority for day-to-day management and administration of the project aspects of physics and computing. The Director of BNL, or his/her designee, is responsible for management oversight of the project and DOE and NSF jointly provide requirements, objectives and funding.

2.2 International ATLAS and its Project Management

The large general-purpose LHC experiments rank among the most ambitious and challenging technical undertakings ever proposed by the international scientific community. The inter-regional collaborations assembled to design, implement and execute these experiments face unprecedented sociological challenges in marshaling efficiently their enormous, yet highly decentralized, human and economic resources. The overall ATLAS approach to this challenge is to base most of the ATLAS governance on the collaborating institutions rather than on any national blocks. Thus the principal organizational entity in ATLAS is the Collaboration Board (CB), consisting of one voting representative from each collaborating institution, regardless of size or national origin.

The CB is the entity within ATLAS that must ratify all policy and technical decisions, and all appointments to official ATLAS positions. It is chaired by an elected Chairperson who serves for a non-renewable two-year term. The Deputy Chairperson, elected in the middle of the Chairperson's term, succeeds the Chairperson at the end of his/her term. The CB Chairperson has appointed (and the CB ratified) a smaller advisory group with whom he/she can readily consult between ATLAS collaboration meetings.

For Physics and Computing, the ATLAS National Computing Board (NCB) has one representative member per participating country, and is constituted to oversee the allocation of contributed resources to the needs of ATLAS computing. It reports to the Computing Oversight Board (COB), consisting of the Spokesperson, Deputy Spokesperson, Computing Coordinator and Physics Coordinator on resource and policy issues involving computing at the member countries in ATLAS.

Executive responsibility within ATLAS is carried by the Spokesperson who is elected by the CB to a renewable three-year term. The Spokesperson is empowered to nominate one or two deputies (there is presently one) to serve for the duration of the Spokesperson's term in office. The Spokesperson represents the ATLAS Collaboration before all relevant bodies, and carries the overall responsibility for the ATLAS Detector Project.

The ATLAS Spokesperson chairs and Executive Board (EB), consisting of high-level representatives of all the major detector subsystems, the Technical and Resource Coordinators, the Physics and Computing Coordinators. The Executive Board directs the execution of the ATLAS project according to the policies established by the Collaboration Board.

It is understood that the U.S.-ATLAS management must operate within the regulations imposed by the U.S. funding agencies, the funding appropriated by the U.S. Congress, and the terms of the U.S.-CERN Protocol on LHC Experiments. Subject to these limitations, it is expected that the U.S.-ATLAS management responds to all decisions taken by the ATLAS Resource Review Board (RRB) and the Collaboration Board. The RRB comprises representatives from all ATLAS funding agencies and the managements of CERN and the ATLAS Collaboration. The U.S. has DOE and NSF representatives. The RRB meets twice per year, usually in April and October.

The role of the RRB includes:
reaching agreement on the ATLAS Memorandum of Understanding
monitoring the Common Projects and the use of the Common Funds
monitoring the general financial and manpower support
reaching agreement on a maintenance and operation procedure and monitoring its functioning
endorsing the annual construction and maintenance and operation budgets of the detector

As far as project execution is concerned, decisions by the ATLAS Executive Board (EB) should also be adopted directly or, if not compatible with the U.S. operating procedures, adapted so as to match the EB decision as closely as possible. In the latter case ATLAS management should be consulted and informed about the detailed U.S. implementation.

2.3 ATLAS Physics and Computing Organization

The ATLAS Physics and Computing Project (see Appendix 4) is managed by two co-leaders, one is the Physics Coordinator, who is in charge of organizing efforts in the area of physics objects, event generators and benchmark studies. The other is the Computing Coordinator who is directly responsible for ensuring that the computing goals of the experiment are met on time and on budget in a way the guarantees the required performance and reliability objectives. The Computing Project is overseen by a technically oriented Computing Steering Group, consisting of representatives from each major detector subsystem in the areas of simulation, reconstruction and data management. In addition to the subsystem-based representation, there is one overall leader in the area of data management, simulation and reconstruction. See Appendix 3 for a management diagram.

The National Computing Board (NCB) consists of one representative from each country in the collaboration, and has an elected chair who serves for a two year term.

Software agreements are discussed between the relevant NCB representatives and in the CSG. This discussion focuses on the available resources from any given country and the needs of ATLAS. After discussion between these two groups, a proposal for the Institutional Commitments for Computing deliverables is made to the Collaboration Board, which approves the Software Agreements. The Software Agreements are then reviewed by the RRB and are approved by the Research Director of CERN and codified as Memoranda of Understanding for Computing.

2.4 Membership of the U.S.ATLAS Collaboration

The U.S. ATLAS Collaboration consists of physics and software professionals from U.S. ATLAS institutions collaborating on the ATLAS experiment at the CERN LHC. Table 2-1.shows a list of the participating institutions. Individuals from these institutions share responsibility for the construction and

execution of the experiment with collaborators from the international high-energy physics community outside the U.S. Members of the U.S. ATLAS Collaboration take on responsibilities for computing and physics within the ATLAS experiment. Major portions of these responsibilities may be funded as part of the U.S. ATLAS Physics and Computing Project, and these responsibilities may become the subject of Software Agreements and/or Memoranda of Understanding between U.S. ATLAS and the ATLAS experiment. These aspects are subject to Project management and control. Other aspects, such as detector specific contributions (e.g. to reconstruction algorithms) are part of the base program, and may also be the subject of Software Agreements and/or Memoranda of Understanding. Project funded activities that are the subject of Software Agreements and/or Memoranda of Understanding between U.S. ATLAS and the ATLAS experiment are codified in the form of Institutional Memoranda of Understanding between U.S. ATLAS and the collaborating institution. See Appendix 10 for List of Institutional Responsibilities.

Table 2-1: U.S. ATLAS Participating Institutions

(Agency support shown in parentheses)

Argonne National Laboratory (DOE)
University of Arizona (DOE)
Boston University (DOE)
Brandeis University (DOE/NSF)
Brookhaven National Laboratory (DOE)
University of California, Berkeley/Lawrence Berkeley National Laboratory (DOE/NSF)
University of California, Irvine (DOE/NSF)
University of California, Santa Cruz (DOE/NSF)
University of Chicago (NSF)
Columbia University (Nevis Laboratory) (NSF)
Duke University (DOE)
Hampton University (NSF)
Harvard University (DOE/NSF)
University of Illinois, Urbana-Champaign (DOE)
Indiana University (DOE)
Iowa State University (DOE)
Massachusetts Institute of Technology (DOE)
University of Michigan (DOE)
Michigan State University (NSF)
University of New Mexico (DOE)
State University of New York at Albany (DOE)
State University of New York at Stony Brook (DOE/NSF)
Northern Illinois University (NSF)
Ohio State University (DOE)
University of Oklahoma/Langston University (DOE)
University of Pennsylvania (DOE)
University of Pittsburgh (DOE/NSF)
University of Rochester (DOE/NSF)
Southern Methodist University (DOE)
University of Texas at Arlington (DOE/NSF)
Tufts University (DOE)
University of Washington (NSF)
University of Wisconsin, Madison (DOE)

2.5 U.S. ATLAS Project Management Structure

The U.S. ATLAS Physics and Computing Project is undertaken as part of the LHC Research, Software and Computing Plan, as described in the Host Lab letters signed by the DOE/NSF and BNL Director, dated November 2000 and August 1999. This letter is in Appendix 8.

To facilitate interactions with the U.S. funding agencies and for effective management of U.S. ATLAS activities and resources, a project management structure has been established with the Project Office located at BNL. Appendix 1 shows the organization chart for U.S. ATLAS. This organization is headed by a U.S. ATLAS Project Manager supported by a Project Office along with U.S. Subsystem Managers for each of the major detector elements in which the U.S. is involved. The organization also includes an Institutional Board with representation from each collaborating institution, and an Executive Committee. The responsibilities of each will be described below. The U.S. ATLAS planning and management is being done in close cooperation with the overall ATLAS management. The U.S. Subsystem Managers interact closely with the corresponding overall ATLAS Subsystem Project Leaders, and the U.S. ATLAS Project Manager maintains close contact with the ATLAS Spokesperson, and the Technical and Resource Coordinators.

2.5.1 U.S. ATLAS Project Manager

The U.S. ATLAS Project Manager (PM) has the responsibility of providing programmatic coordination and management for the U.S. ATLAS Construction Project and the Research Program addressed here. He/she represents the U.S. ATLAS Project in interactions with overall ATLAS management, CERN, DOE, NSF, the universities and national laboratories involved and BNL, the Host Laboratory. The PM is appointed by the Director of BNL and with concurrence of the DOE and NSF upon recommendation from the U.S. ATLAS Collaboration. The PM will serve as long as there is the continuing confidence of the Collaboration, the Director of BNL, and the funding agencies. He/she reports to the BNL Director (or his/her appointed representative). In the event that a new PM is chosen, the selection of the new PM will require the concurrence and confidence of the Collaboration, the Director of BNL, and the funding agencies. He/she reports to the BNL Director (or his/her appointed representative). The PM is advised in this role by an Executive Committee, which includes all U.S. Subsystem Managers, as described below. The PM may select a Deputy to assist him. With respect to technical, budgetary, and managerial issues, the U.S. Subsystem Managers, augmented by the Institutional Board Convener, act as a subcommittee of the Executive Committee to provide advice to the PM on a regular basis. Consultation with this subcommittee is part of the process by which the PM makes important technical and managerial decisions. An example of such a managerial decision would be a modification of institutional responsibilities. The management responsibilities of the U.S. ATLAS Project Manager include:

- Appointing, after consultation with the Collaboration, of U.S. Subsystem Managers (SMs) responsible for coordination and management within each detector subsystem. The SMs will serve with the PM's continuing concurrence.

- Preparing the yearly funding requests to DOE and NSF for the anticipated U.S. ATLAS activities.

- Recommending to DOE and NSF the institution-by-institution funding allocations to support the U.S. ATLAS efforts. These recommendations will be made with the advice of the SMs, and the U.S ATLAS Executive Committee.

- Approving budgets and allocating funds in consultation with the SMs and managing contingency budgets in accord with the Change Control Process in Section 4.5.

- Establishing, with the support of BNL management, a U.S. ATLAS Project Office with appropriate support services.

- Working with BNL management to set up and respond to whatever advisory or other mechanisms BNL management feels necessary to carry out its oversight responsibility.

- Keeping the BNL Director or his chosen representative well informed on the progress of the U.S. ATLAS effort, and reporting promptly any problems whose solutions may benefit from the joint efforts of the PM and BNL management.

- Interacting with CERN on issues affecting resource allocation and availability, preparation of the international MOUs defining U.S. deliverables and concurring in these MOUs.

- Advising the DOE and NSF representatives at the ATLAS Resource Review Board meetings.

- Negotiating and signing the U.S. Institutional MOUs representing agreements between the U.S. ATLAS Project Office and the U.S. ATLAS collaborating institutions specifying the deliverables to be provided and the resources available on an institution-by-institution basis.

- Periodically reporting on project status and issues to the Agencies and the Joint Oversight Group.

- Conducting, at least twice a year, meetings with the U.S. ATLAS Executive Committee to discuss budget planning, milestones, and other U.S. ATLAS management issues.

- Making periodic reports to the U.S. ATLAS Institutional Board to ensure that the Collaboration is fully informed about important issues.

The channels for funding, reporting, and transmission of both types of MOUs are shown in Construction PMP. DOE funding will be a mixture of grants and Research Contracts through BNL. NSF funding will be through subcontracts through Columbia University. Further details on the identities and roles of the various participants in the U.S. ATLAS Collaboration governance are given below.

2.5.2 Institutional Board

The U.S. ATLAS Collaboration has an Institutional Board (IB) with one member from each collaborating institution and a Convener elected by the Board. The Convener serves for a two-year renewable term. The IB will normally meet several times per year. Under normal circumstances the meetings are open to the Collaboration, although closed meetings may be called by the Convener to discuss detailed or difficult issues. All voting is by IB members only, except in the case of the absence of a member when the missing member may appoint an alternate.

The IB members represent the interests of their institutions and serve as points of contact between the U.S. ATLAS management structure and the collaborators from their institutions. They are selected by the ATLAS participants from their institutions.

The Institutional Board deals with general policy issues affecting the U.S. ATLAS Collaboration. As chairman of this board the Convener will organize meetings on issues of general interest that arise and will speak for U.S. ATLAS on issues that affect the Collaboration. The Convener also will recommend for ratification to the Institutional Board the ad hoc committees charged with running the elections for the Convener and for the membership of the Executive Committee, as described in the next section. The Convener will recommend to the Institutional Board the establishment of any standing committees to deal

with collaboration wide issues if the need arises. The Institutional Board also provides its recommendation on the appointment of the Project Manager to the BNL Director, and DOE and the NSF.

2.5.3 Executive Committee

The Executive Committee advises the Project Manager on global and policy issues affecting the U.S. ATLAS Collaboration or the U.S. ATLAS Construction and the Physics and Computing Projects. It also deals with issues external to the U.S. ATLAS Construction Project such as education, computing, physics analysis etc. The Executive Committee has meetings at least twice per year. Its membership is the following:

The Deputy Project Manager,
Associate Project Manager for Physics and Computing,
Subsystem Managers, including each level 2 manager from the Physics and Computing Project (PCP)
The Subsystem Representatives from each subsystem in which U.S. groups are playing a major role, their number being given in parentheses:

- Semiconductor tracker (1),
- TRT (1),
- Liquid argon calorimeter and forward calorimeter (2),
- Tile calorimeter (1),
- Muon spectrometer (2),
- Trigger/DAQ subsystems (1),

The Education Coordinator,
The U.S. members of the overall ATLAS Executive Board,
The Convener of the Institutional Board.

The Subsystem Representatives are elected for two-year renewable terms by the IB members whose institutions are associated with the given subsystem.

The Education Coordinator, also elected for a two-year renewable term by the IB, is expected to actively promote educational programs associated with ATLAS and with the U.S. member institutions, and to report to the Executive Committee on these issues. He/she will also act as liaison to DOE and NSF for educational activities. The intended audiences for these education activities are a) the general public, b) secondary school students, c) undergraduates, and d) primary and secondary school teachers.

2.5.4 Associate Project Manager for Physics and Computing

The Associate Project Manager for Physics and Computing (APM) is responsible for the technical, schedule and cost aspects of the U.S. ATLAS Physics and Computing Project. (The scope of the U.S. ATLAS Physics and Computing Project is part of the U.S. preparations for participation in the ATLAS research program and is not part of the U.S. ATLAS Construction Project.) This Physics and Computing Project will follow all the features of this Project Management Plan in terms of defining a WBS for the deliverables, a detailed cost estimate and resource-loaded schedule, controls and reporting. The APM develops the budgets for the institutions participating. The U.S. ATLAS Project Manager appoints the APM with concurrence from the Executive Committee. The APM appoints Software, Facilities and Physics Subsystem Managers with the concurrence of the Executive Committee.

2.5.5 Computing Subsystem Managers

The Computing Subsystem Managers are responsible for the technical, schedule, and cost aspects of their subsystems. They develop the budgets for the institutions participating in their subsystems. They are appointed by the Associate Project Manager upon recommendation of the IB members whose institutions are involved in that subsystem. The Computing Subsystem Managers, augmented by the Institutional Board Convener, also act as a subcommittee of the Executive Committee advising the APM on technical, budgetary,

and managerial issues relevant to the U.S. ATLAS Computing Project. Prior to making important technical and managerial decisions, the APM will consult with this subcommittee.

2.5.6 Information Technology Development

The computing and software systems being designed for the LHC face a series of unprecedented challenges associated with communication and collaboration at a distance, long term robust operation, globally distributed computational and data resources. In addition to the demands on computing associated with models of data analysis seen in previous generations of experiments, the size of the LHC collaborations produce an additional challenge. Future computing and software systems must provide rapid access to global collaborations to massive distributed computing and data archives, must operate across networks of varying capabilities, and must possess sufficient robustness and flexibility to support international collaborative research over a period of decades. The creation of such information technology systems requires careful design using modern engineering tools and close collaboration with computer professionals and industry.

Recent dramatic increases in network capacities have opened new possibilities for collaborative research, placing networks in a position of strategic importance for global collaborations, such as ATLAS. The recent development of Data Grids offers a comprehensive framework for supporting collaborative research. Data Grids are geographically separated computation resources, configured for shared use with large data movement between sites. Such grids preserve local autonomy while providing an immense, shared computing resource that can be accessed anywhere in the world.

U.S. ATLAS is working with a number of groups that are working on Data Grids, both in the U.S. and in Europe. These groups are collaborations of physicists and computer scientists who are working on the implementations of specific protocols and provide feedback to the computer scientist developers on the needs of their experiments. These collaborations include the NSF sponsored GridPhysicsNetwork (GriPhyN) and the international Virtual Data Grid (iVDG), the DOE sponsored Particle Physics Data Grid (PPDG) and the European Data Grid project. In addition to these, smaller IT funding sources are utilized which support the project, but would come under the heading of IT research as well. The collaborations with computer scientists necessitates a coherent structure within the U.S. ATLAS project that can interact with these external organizations to produce a usable system.

It is critical that the U.S. ATLAS Physics and Computing Project have well identified connections to the external groups engaged in research and development work on data grids to assure a well-integrated program. To this end, U.S. ATLAS establishes a designated single point of contact who acts as a liaison to the external groups. Funds earmarked for U.S. ATLAS use in these collaborative efforts are tagged as project funds and subject to the same tracking controls as other project funds. These funds have a special designation to enable separate tracking. A list of the liaison personnel and their direct supervisors are listed below.

Collaboration	Liaison	Manager
GriPhyN Collaboration	R. Gardner	T. Wenaus
Grid Telemetry	R. Gardner	R. Baker/B. Gibbard
Particle Physics Data Grid	T. Wenaus	T. Wenaus
European Data Grid	C. Tull	T. Wenaus
HEP Networking	S. McKee	R. Baker/B. Gibbard
iVDGL	R. Gardner/J. Huth	R. Baker/B. Gibbard

2.5.7 Brookhaven National Laboratory (BNL) and Columbia University

The DOE and NSF have assigned BNL management oversight responsibility for the U.S. ATLAS Construction Project, as well as the U.S. ATLAS Research Program. This responsibility was conveyed in a letter from the agencies (see Appendix 8). The BNL Director has the responsibility to assure that the detector effort is being soundly managed, that technical progress is proceeding in a timely way, that technical or financial problems, if any, are being identified and properly addressed, and that an adequate management organization is in place and functioning. The BNL Director has delegated certain responsibilities and authorities to the Associate Laboratory Director for High Energy and Nuclear Physics. The Associate Director is responsible for day-to-day management oversight of the Construction Projects and the U.S. ATLAS Project Manager reports to him. Specific responsibilities of the BNL Directorate include:

- Establish an advisory structure external to the U.S. ATLAS project for the purpose of monitoring both management and technical progress for all U.S. ATLAS activities;
- Assure that the Project Manager has adequate staff and support, and that U.S. ATLAS management systems are matched to the needs of the project;
- Consult regularly with the Project Manager to assure timely resolution of management challenges;
- Concur with the International Memorandum of Understanding specifying U.S. deliverables for the U.S. ATLAS project funded by DOE and NSF.
- Concur with the institutional Memoranda of Understanding for the U.S. ATLAS collaborating institutions that specify the deliverables to be provided and the resources available for each institution;
- Ensure that accurate and complete project reporting to the DOE and NSF is provided in a timely manner.
- Approve any Baseline Change Proposals.

The NSF Division of Physics has delegated financial accountability to Columbia University in the domain of the core computing activities, with contract administration as described in the NSF - Columbia Cooperative Agreement. The Director of Nevis Laboratory is responsible for dispersal of NSF funds according to the allocations recommended by the U.S. ATLAS Associate Project Manager for Physics and Computing, approved by the U.S. ATLAS Project Manager and consistent with NSF policies. In non-core computing activities, such as cooperative research and development between U.S. ATLAS members and computer scientists, funds may be allocated as part of individual grants to U.S. ATLAS institutions from both the NSF and the DOE. Components of these individual grants are identified as under project control and work performed under these auspices are subject to project control functions.

A proposal requesting support from the NSF for Computing, M&O and Upgrades has been submitted to the NSF in October 2001 entitled: “The ATLAS Research Program: Empowering U.S. Universities.”

2.5.8 Project Advisory Panel

The Project Advisory Panel (PAP) is appointed by the Brookhaven Associate Laboratory Director, High Energy & Nuclear Physics. The role of the PAP in the U.S. ATLAS Detector Project is to provide oversight of the work performed in the Project plus advice to Laboratory management on the rate of progress in and

adherence to the project plan as it relates to cost, schedule and technical performance. The primary mechanism for performing this oversight role is attendance at the Project Manager's periodic technical reviews of the U.S. ATLAS subsystems, followed by discussions among the attending PAP members with Project principals and Subsystem Managers. If necessary, additional other mechanisms may be employed as deemed necessary to exercise the oversight function. These may include special reviews or meetings and attendance at Department of Energy/National Science Foundation (DOE/NSF) reviews of the U.S. ATLAS Project. The PAP reports to Laboratory management by means of oral discussions plus a written report following each significant PAP review. PAP reports are transmitted to DOE and NSF.

2.5.9 Physics and Computing Advisory Panel

The Physics and Computing Advisory Panel (PCAP) is appointed by U.S. ATLAS Project Manager. The role of the PCAP in the U.S. ATLAS Detector Project will be to provide advice to the PM and APM on the development of, and on the rate of progress in and adherence to this Physics and Computing Project plan as it relates to cost, schedule and technical performance.

2.6 Department of Energy (DOE) and National Science Foundation (NSF)

The Department of Energy (DOE) and the National Science Foundation (NSF) are the funding agencies for the U.S. ATLAS Construction Project. As such they monitor technical, schedule, and cost progress for the program. The organizational structure is shown in Appendix 2.

The DOE has delegated responsibility for the U.S. ATLAS activities to the Office of Science, Division of High Energy Physics. The NSF has delegated responsibility for the U.S. ATLAS project to the Division of Physics, Elementary Particle Physics Programs.

The U.S. ATLAS Project receives substantial support from both DOE and NSF. Almost all the subsystems involve close collaboration between DOE and NSF supported groups. It is therefore essential that DOE and NSF oversight be closely coordinated. The DOE and NSF have agreed to establish a Joint Oversight Group (JOG) as the highest level of joint U.S. LHC Program management oversight. The JOG has responsibility to see that the U.S. LHC Program is effectively managed and executed so as to meet the commitments made to CERN under the International Agreement and its Protocols. The JOG provides programmatic guidance and direction for the U.S. LHC Construction Project and the U.S. LHC Research Program and coordinates DOE and NSF policy and procedures with respect to both. The JOG approves and oversees implementation of the U.S. LHC Project Execution Plan (PEP) and individual Project Management Plans which are incorporated into the PEP including the U.S. ATLAS Construction Project Management Plan.

All documents approved by JOG are subject to the rules and practices of each agency and the signed Agreements and Protocols.

The U.S. LHC Program Office and U.S. LHC Project Office are established to carry out the management functions described in the PEP. As the DOE has been designated lead agency for the U.S. LHC Program, the U.S. LHC Program Manager and the U.S. LHC Project Manager, who respectively head the program and project offices, will generally be DOE employees. The Associate U.S. LHC Program Manager will generally be an NSF employee.

Funding is derived from a number of sources. The National Science Foundation intends to support the majority of the U.S. ATLAS Physics and Computing Project through a multi-year proposal, which is effective from 2002 through the start of data taking. This will be covered in a new cooperative agreement with Columbia University (2.5.7), which is distinct from the cooperative agreement established for construction funds, which are capped. In addition to these funds, the funds employed as part of the Data Grid Projects are accounted for as Project funds and subject to tracking. Prior to the funding of the multi-year

grant from the NSF, funding support from the NSF was derived from a grant administered through Columbia University.

The Department of Energy provides funding through Brookhaven National Laboratories and also as direct installments to the financial plans of the participating National Laboratories, Argonne National Laboratory and Lawrence Berkeley National Laboratory. The funding level is communicated to the APM as an overall profile that terminates at the end of the fiscal year 2007, when the Project makes the transition to the Research Program.

2.6.1 U.S. LHC Program Office

The U.S. LHC Program Office has the overall responsibility for day-to-day program management of the U.S. LHC Program as described in the PEP. In this capacity, it reports directly to the JOG and acts as its executive arm. The office is jointly responsible with the U.S. LHC Project Office for preparation and maintenance of the PEP, and interfaces with the DOE Division of High Energy Physics and the NSF Division of Physics, which are the respective agency offices charged with responsibility to oversee the U.S. LHC Program. The Program Manager and Associate Program Manager are responsible for coordination between the agencies of the joint oversight activities described in the Memorandum of Understanding between DOE and NSF and in the PEP.

2.6.2 U.S. LHC Project Office

The U.S. LHC Project Office is responsible for day-to-day oversight of the U.S. LHC Projects as described in the PEP. In this capacity, the U.S. LHC Project Manager reports to the U.S. LHC Program Manager, and routinely interfaces with the Project Managers for each of the U.S. LHC Projects. These managers represent the contractors and grantees to DOE and NSF. These contractors and grantees have direct responsibility to design, fabricate, and provide to CERN the goods and services agreed in the International Agreement and Protocols.

3 Physics and Computing Project

There are two primary goals of the U.S. ATLAS Physics and Computing Project. The first is to provide the software, computing and support resources to enable collaborating U.S. physicists to fully participate in, and make significant contributions to the physics program of ATLAS. The second primary goal is to contribute to the overall ATLAS Computing effort to a degree that is both commensurate with the proportionate scale of the U.S. contributions to the detector construction and well matched to the expertise of the U.S. physicists specializing in computing.

The computing effort for the ATLAS experiment far exceeds that of previous high-energy physics experiments in the scale of data volume, CPU requirements, data distribution across a global network, complexity of the software environment, and a widespread geographic distribution of developers and users of software.

There are three components of the Physics and Computing Project:

- Physics: Support of event generators, physics simulation, specification of physics aspects of facilities support.

- Software: Development and maintenance of software deliverables to the International ATLAS project, as specified in software agreements and memoranda of understanding between CERN, the International ATLAS Collaboration and the U.S. ATLAS Physics and Computing Project.

- Facilities: Hardware, networking and software support of U.S. Collaborators in data analysis and in computing contributions to the ATLAS Collaboration.

The Physics and Computing Project covers the period from 1999 through the duration of the experiment. The Physics and Computing Project is delineated into two phases. In the first phase, covering the period from 1999, through the start of data taking, expected in 2006, the Physics and Computing Project is associated with the Construction Phase of the Project. After 2006, the Physics and Computing Project is associated with the Research and Operations Project. The relation of the Physics and Computing Project to the Construction and to the Research and Operations Project are described in their respective Project Management Plans.

3.1 Physics and Computing Subproject Management

The project organization is presented in Appendix 3. The structure of the project organization reflects the three main components of the Physics and Computing Project: physics, facilities and software deliverables. These three components have level 2 WBS specifications and corresponding level 2 managers. The management structure is designed to reflect a division of labor in the responsibilities for deliverables to International ATLAS.

- Physics: Support of event generators, physics simulations and algorithms for physics objects as agreed to by International ATLAS and U.S. ATLAS.
- Software: Software deliverables are agreed to by International ATLAS and U.S. ATLAS.
- Facilities: Specifications of platform needs of U.S. ATLAS are negotiated with International ATLAS in the formulation of policies. Data and software releases are delivered from International ATLAS to U.S. ATLAS, where local support functions are provided for both.

3.1.1 Physics

The goal of the physics subproject is to provide support functions for physics related tasks for the U.S. ATLAS Collaboration and fulfill specific responsibilities as negotiated with International ATLAS, such as support of certain event generators. The physics subproject deals with the development and maintenance of reconstruction algorithms for classes of physics objects (e.g. jets, missing energy). The physics subproject role also involves the establishment of crucial benchmark studies to measure the performance of software and facilities systems, in particular the coordination of mock data challenges for U.S. Facilities. There will be a substantial independence of all collaborators, U.S. and Internationally, in the area of data analysis, with the principle of democratic access to the data.

3.1.2 Software

The goal of the software subproject is to provide a set of deliverable software packages to U.S. ATLAS, the International ATLAS Collaboration and CERN, as negotiated with these organizations and specified in the form of software agreements and Memoranda of Understanding. Within the project, software is divided into the following categories:

- Core: General purpose software that is not specific to a given detector subsystem

- Detector specific simulation and reconstruction
- Training
- Collaborative tools
- Development and support of the software infrastructure to ensure U.S. Collaborators can perform successful analyses

Note that traditionally, detector specific simulation and reconstruction activities have been carried out by physicists and in the past have not involved the use of Project funds for their support. With modern software methodology, and with the increased complexity associated with the scale of the project, it is necessary to have a more systematic approach to this, including the use of some software professionals to support the activities of physicists and assist in the maintenance of reconstruction and simulation packages. Much of the specifications of reconstruction algorithms are based on decisions made by the International ATLAS Collaboration, and duties associated with the project include the implementation, documentation and maintenance of the associated software packages.

Requirements on the software are developed by the International ATLAS Collaboration, and deliverables are negotiated with the International Collaboration as part of software memoranda of understanding.

3.1.3 Facilities Subproject

The goals of the facilities subproject is to provide the basis for the support of U.S. ATLAS physicists in the analysis of data from the ATLAS experiment, and to carry out specific computing tasks for the International ATLAS experiment as per agreement between the two. The facilities subproject consists of the following major pieces:

- Regional (Tier 1) computing center at Brookhaven National Laboratory.

- Software support of a code repository at BNL and support of U.S. Physicists in the use of ATLAS software.

- Tier 2 centers. There will be roughly 5 tier 2 centers for U.S. ATLAS. These are to be linked together and with the Tier 1 center to form a coherent computing grid environment. Software and hardware support functions are also carried out at these locations.

- Participation in the construction of grid software.

- Modeling tasks to optimize resource usage.

Tier 2 Centers: The selection criteria for Tier 2 centers are detailed in the memo to the collaboration in Appendix 5.

3.2 Upper level project management: description of responsibilities

Associate Project Manager

- Develop a project plan, conforming to the technical and scientific needs and policies of ATLAS and U.S. ATLAS.

- Manage execution of the approved project plan.

- Establish and maintain the project organization and tracking, with the resources of BNL; this includes the management of procurements, schedules, reporting, etc.

- Develop the annual budget request to the DOE and NSF; the budget requests are reviewed by the level 2 project managers and are approved by the Project Manager.

- Act as a liaison between the project and the ATLAS Computing management.

- Appoint the L2 managers with the advice and concurrence of the EC and Project Manager.

- Provide coordination and management direction to the subprojects, including requirements for appropriate reporting and tracking, and responses to technical reviews.

- Review and approve memoranda of understanding (MOU) between CERN and the Project.

- Allocate budgets and resources within the project.

- Exercise change control authority within project change control protocols.

- Establish advisory committees where appropriate, and project obligations.

- Provide reports and organize reviews in conjunction with the funding agencies.

- Review and approve institutional memoranda of understanding (IMOU) between the Project Office and U.S. ATLAS institutions.

Level 2 Managers: Generic Responsibilities

The level 2 managers share a common set of responsibilities in their relation to the project. These are to:

- Develop, in collaboration with the APM the definitions of the milestones and deliverables of the subproject.

- Develop, subject to review by the APM, the technical specifications of each component and deliverable of the sub-project.

- Define, in consultation with the APM the organizational substructure of the subproject.

- Develop, with the guidance of the APM, the annual budget proposal for the subproject.

- Identify resource imbalances within their subprojects and recommend adjustments within the limits of the allocated resources.

- Manage execution of the full scope of the subproject on schedule, within budget and in conformance with the technical specifications of the project.

- Be accountable for all funding and resources allocated to the subproject.

- Develop and maintain the cost and schedule plan for the subproject.

- Provide reports and tracking information as required to the APM, PM.

- Assist the APM in the development of MOU's between the Physics and Computing Project and CERN

- Assist the APM in the development of MOU's between the U.S. ATLAS Project and participating institutions. Assess the resource requirements of proposed U.S. ATLAS software deliverables to ensure a proper matching between resources and deliverables.

- Implement QA/QC policies as specified by the international ATLAS Collaboration.

Physics Subproject Manager

- Provide support for physics generators, simulations, and physics object algorithms as per agreement with International ATLAS

- Provide support for physics objects

- Create schedule and oversee the execution of benchmark studies to assess software and facilities readiness

- Manage the user side of the mock data challenges

- Provide requirements for the U.S. ATLAS computing facilities and relevant software packages

Software Subproject Manager

- Provide oversight to agreed simulation/reconstruction activities undertaken by U.S. ATLAS groups.

- Provide oversight and input to the U.S. ATLAS Training Coordinator in relevant software technologies.

- Appoint level 3 and 4 managers in the software subproject, with the advice and concurrence of the APM.

- Assess the needs of U.S. Physicists for support of ATLAS software packages, develop and implement a support plan.

- Assess the technical risks of implementation strategies being proposed by participating U.S. Institutions and advise the APM and International ATLAS of any unacceptable risks

- Oversee core software and collaboratory tool deliverables from the U.S.

Facilities Subproject Manager

- Assess the resource requirements of proposed U.S. ATLAS facilities and develop a plan to meet these requirements at the regional center.
- Manage the implementation of the plan for the U.S. ATLAS computing facilities.
- Represent the U.S. ATLAS Physics and Computing Project on matters related to computing at regional centers.
- Develop and maintain a plan to address the U.S. contributions to the computational needs of the ATLAS experiment, including data analysis and simulation.
- Appoint level 3 and 4 managers in the Facilities subproject, with the advice and concurrence of the APM.

3.2.1 Computing Coordination Board

The Computing Coordination Board is jointly chaired by the Physics Manager and the IB Chair. Sitting on the board are the Associate Project Manager for Physics and Computing, the Software and Facilities Managers and three other representatives from the U.S. ATLAS Collaboration. The three at-large representatives are selected by the Institute Board. The purpose of the Computing Coordination Board is to aid in the allocation of existing resources and assess the needs of the collaboration, and provide advice to the Associate Project Manager on these issues. The Computing Coordination Board represents the means for direct input from the U.S. ATLAS Collaboration into the Physics and Computing Project. The co-chairs are delegated to poll the Collaboration on any Physics and Computing issues as they see fit, and to organize Physics and Computing sessions as they see fit. The Computing Coordination Board also oversees the selection of sites for Tier 2 centers.

3.2.2 Institutional Responsibilities

Institutional responsibilities are assigned via an Institutional Memorandum of Understanding that is signed once for the duration of the physics and computing project, and has a high-level signator in the institution who can guarantee the use of facilities or other support in the institution, along with the Associate Manager for Physics and Computing and the concurrence of the overall project manager. Statements of work are agreed to on an annual basis and are signed by the Associate Manager for Physics and Computing and an identified principal at the institution. Changes to Institutional Memoranda of Understanding are covered under the change control process.

3.3 Software Agreements

Software agreements are established between the International ATLAS Collaboration and the U.S. Physics and Computing Project. In the Software agreements, specific areas of responsibility are delineated as per the U.S. ATLAS WBS and International ATLAS PBS as the domain(s) of applicability of the agreement. Software agreements may include multiple WBS/PBS items at different levels. The software agreements include an overall description of the effort, including the basis for modification of the agreement, a specification of the deliverable expected, the duration of the agreement and a rough indication of the level of effort required in FTE's for the agreement. The software agreements also include a technical annex(es) that establish the requirements associated with the deliverable and, in effect, represent a description of the deliverable. It should be noted that requirements will change, and when they do, the technical annex can be updated with no additional approval necessary, providing there is not

a significant corresponding change in the level of effort required. The software agreement is signed by the Physics Coordinator for International ATLAS, the APM for Physics and Computing, the Spokesperson for International ATLAS, the Project Manager, the Resource Manager for International ATLAS and the Associate Director of BNL under whom the Project is organized. In addition, for multi-lateral software agreements, the corresponding representative of involved countries and institutions will also sign.

3.4 International Memoranda of Understanding

Memoranda of Understanding encompassing software deliverables and analysis and computing support will be created between International ATLAS and CERN on the one hand, and the U.S. ATLAS Physics and Computing Project on the other. The international MOU will encompass and supercede the group of Software Agreements pertaining to the U.S. ATLAS software deliverables, and, in addition, will describe the facilities under U.S. ATLAS Project Management that are to part of an overall shared resource of computing facilities employed by International ATLAS and CERN for data analysis. The international MOU will be signed by the spokesperson of ATLAS, the Head of the IT Division at CERN, the International ATLAS Computing and Physics Coordinators, the APM for Physics and Computing, the Project Manager, and the Associate Laboratory Director for Brookhaven National Laboratory. When the International Memorandum of Understanding is complete, this section will be updated to reflect that fact.

3.5 Computing and Physics Policies

A number of policy issues must be spelled out. These include local platform support, and the use of physicists within the project.

3.5.1 Local Computing Hardware Support

Until the establishment of Tier 2 centers, most of the CPU and I/O intensive computing jobs are to be performed at the Tier 1 regional center. It is recognized that there is a need for modest platform support locally at institutions for the purposes of development. Modest support will be provided for software development at institutions that have taken on a significant responsibility, providing a working arrangement can be made such that there is coordination in the purchase of U.S. supported platforms, and the understanding that the majority of the computation is to be carried out at the Tier 1 center. As Tier 2 centers are established, there will be a net migration of some effort to these areas.

3.5.2 Physicist Support

It is recognized that there will be a substantial amount of physicist support required. This is estimated to be at the level of roughly 50 post-doctoral scientists at the start of active data taking. As a matter of policy, it is noted that physicists are not to be included in the project funding, yet this is a substantial amount of manpower which much exist in order for the U.S. ATLAS Physics and Computing Goals to be met. These physicists must come from the base program. Ideally a large fraction of this may be incremental or may be the result of redirection of effort.

We note that there is an additional category of support staff, which is considered to be on project. This is in the category of applications physicist. An applications physicist is typically a computer professional who has a strong background in physics and computing, and is not on an academic track. In the areas of detector specific simulation and reconstruction, we expect that there will be roughly two applications physicists per subsystem contributing to the development and maintenance of software deliverables. Some personnel may be split between part-time appointments, part research, part applications support, with the research portion supported by the base program.

3.5.3 Software Licensing

Software licensing costs for the Regional Center and officially established Tier 2 centers are considered part of the project costs. Long term software maintenance for pieces of code that are deliverables of U.S. ATLAS are included as part of the project costs. For other ATLAS-specific code, it is assumed that these are maintained by institutions that undertake these projects as deliverables, and this maintenance is described as part of the Memoranda of Understanding and/or Software Agreements. Where possible, decisions on software products take into account licensing costs as part of the procurement process.

3.5.4 QA/QC

Standards for software quality assurance and control are set by the International ATLAS collaboration, including coding standards and release policy and management. U.S. ATLAS will adopt all tools agreed upon by the International ATLAS Collaboration. Level 2 and 3 managers in the U.S. ATLAS Physics and Computing Project are responsible for implementing QA/QC policies adhered to by the International ATLAS Collaboration, including the use of common tools adopted by the international collaboration.

3.5.5 Relation to the Construction Project

A number of areas have potential overlap with the construction project. Broadly speaking, any software or computing that is directly in support of, and derives from the construction project falls in the domain of the construction project. Cost sharing between the construction and physics and computing projects are done in areas of project management, where common management tools are employed to the extent possible, and personnel effort are shared between the two projects.

3.5.6 Software Support

Provide site licensing as required for software support of development and use of applications related to analysis.

3.6 Cost Estimates for Physics and Computing

A cost profile of the required funding is shown in Appendix 7. The allocation at a high level between software, facilities, physics, project management, grid R+D and management reserve are indicated as separate categories. The corresponding number of FTE's supported in these profiles is also indicated. The costing is based on an understanding of the actual salaries of people currently on the project, and a scale of software professional salaries that reflects the typical variation among different classes of software professional and regional variations in cost of living.

3.6.1 Training, Collaboratory Tools, Software Support

Training, Collaboratory Tools and Software Support all fall in the domain of the Software part of the Physics and Computing Project (WBS 2.2). Software support is deemed a "level of effort" of one computing professional who maintains ATLAS releases on the U.S. supported platforms and makes available code releases to U.S. users. Training and Collaboratory tools are the means by which the Collaboration is effectively trained in modern computing practices and communication is effected among the collaborators. Although the cost associated with both items are small, it represents a substantial leverage to the overall program.

3.6.2 Facilities

The U.S. ATLAS computing facilities are based on a hierarchical model of sites, starting with the CERN facilities as the primary (Tier 0) site. The assumption is that all of the raw data from ATLAS are stored at this Tier 0 site. The U.S. Regional Center, or Tier 1 site, located at Brookhaven National Laboratories, will cache a subset of this data and perform computing tasks as required both by the ATLAS Collaboration and

U.S. ATLAS in support of U.S. responsibilities and analysis activities. Beyond the Tier 1 sites, are a set of five or six Tier 2 centers, each of which have a fraction of the capabilities of the Tier 1 sites, but in aggregate, the CPU will sum to a level beyond that of the Tier 1 site, whereas the manpower and hardware costs at the Tier 1 site exceed those of the sum of the Tier 2 sites. The various sites in the hierarchy are linked together by a computational grid, which allows transparent access to users and automatic scheduling of resources. The U.S. Facilities support U.S. physicists working on ATLAS and also the International ATLAS Collaboration. The details of the facilities planning are given in the U.S. ATLAS Facilities Workplan.

Requirements for the scale of computing facilities are coupled with the needs of the collaboration and have substantial input from the Physics Manager and the U.S. ATLAS Collaboration at large. The basic principle is to allow the widest possible access to data and CPU power to all users. A major component of this infrastructure is the system of high-bandwidth links between the Tier 1 and Tier 2 sites.

Another aspect of the Facilities subproject is user support, which includes a help desk at the Tier 1 site, and a local storage and release of ATLAS and supporting software. Since there is an ongoing need to perform simulations to optimize trigger performance, shielding, the detector configuration, etc, with many U.S. physicists participating in these exercises, it is essential that the Tier 1 facilities, already in existence at Brookhaven, be maintained and continually upgraded as milestones such as the mock data challenges are approached.

4 Management and Control System

The U.S. ATLAS Physics and Computing Project is based on a build-to-cost philosophy, as the funding profile is neither certain, nor sufficient to employ a deliverable-contingency system. In this philosophy, the requirements of deliverables are scaled to meet the available resources. Some of the funding for the project comes from sources that are not entirely part of the management control structure, and must be viewed as "level-of-effort" and is collaborative in nature.

4.1 Baseline Development

The cost and schedule baseline are organized in a hierarchical work-breakdown structure format (see Appendix 9). The project is dominated by two main components: manpower to produce software and install and support hardware configurations on the one hand, and commodity hardware costs on the other hand. Estimates of personnel effort are the primary estimators for the scope of both software and facility support. Estimates of commodity hardware pricing and extrapolations are the primary estimators for the remaining scope of the facilities subproject. Schedules for deliverables are used as the basis of the establishment of milestones. The current list of High Level Milestones is in Appendix 6. The funding profiles indicated by the funding agencies are then used to estimate the effort required to meet the milestones. After an iterative process where deliverable estimates and schedules are adjusted with the funding profile as a goal, a baseline is established where both the estimated personnel and hardware requirements are applied to meet the milestones. The cost profile, broken out by high-level WBS number, is identified in Appendix 7.

The two areas where effort is delineated are:

- Personnel effort. The amount of effort for any given deliverable, or service, is estimated based on prior experience, and the number of FTE's is used as the baseline. In the case of software deliverables, a sliding scale of requirements is used as the contingency, and the project employs a "build-to-cost" approach where the software deliverable requirements are scaled to match the

available resources. Software agreements, and institutional MOU's will contain statements of the indicative manpower to reach a particular deliverable or produce a reliable service.

- Hardware. Hardware costs are derived from present day commodity pricing, and extrapolated using "Moore's Law", which is an approximately valid scaling of the change in commodity costs as a function of time. It should be noted that "Moore's Law" has been demonstrably valid over long timescales (years), but may show fluctuations when viewed on timescales shorter than a year. As with the personnel effort, allocations of funds for hardware are used to purchase the maximum amount of hardware consonant with the needs of the project for any given pricing.

4.2 Computing Project Performance

Estimates for personnel effort are derived from by resource loading the relevant WBS items, with effort represented as FTE-months. These efforts may include both progress toward a milestone or deliverable, or level of effort in terms of support. This effort is denoted as "Projected Personnel Effort" (PPE). At the relevant level of WBS, the level where the resource loading occurs, project managers are expected to track, on a quarterly basis, the percentage completion of progress toward a milestone, or the percentage of effort compared to expectations. When the percentages are applied against the projected personnel effort, a resulting "Actual Personnel Effort" (APE) is derived. A variance is then generated which compares the PPE to the APE. A negative variance means that effort is falling short of its goals, a positive variance means that the project is progressing faster than anticipated. The entry of a percentage completion, and the metric of PPE versus APE should be regarded as an approximate indicator of performance, and large variances will signal further investigation.

Estimates for performance in terms of hardware installation are based on a goal of the aggregate CPU, networking, disk, tertiary and other capacities at the start of the experiment. Capacities are defined as hardware that has been installed, is functioning and is supported. Given the process of baselining, there is an expectation of the amount of installed, supported hardware, and an actual capacity. The performance is reported in terms of the percentage of the final, installed capacity on a quarterly basis, and compared to the expectation. The difference between the percentage of expected and percentage of installed capacity is used to generate a variance in installed hardware.

4.3 Reporting

4.3.1 Technical Progress

Quarterly Reports

The responsible person in each institution responsible for effort on the Physics and Computing Project (PCP) writes the progress by Level 3 WBS on a quarterly basis. Each item should refer to the appropriate Level 5 WBS element and any relevant milestones which are completed. This is sent to the Computing Subsystem Manager(s). Each Subsystem Manager(s) collates the input and sends it to the Associate Project Manager by the 15th of the month after the end of each quarter. In addition to reporting on progress against milestones, a comparison of performed versus budgeted work in terms of FTE-months and the relevant hardware categories are reported. A summary of actual costs incurred is also made, along with a running tally of costs since the inception of the project. The APM for PCP reviews the reports and collates them into a single report, which is made available to the collaboration. Reports are to be logged centrally at a location associated with the U.S. ATLAS Project Office.

4.4 Procurements

The U.S. ATLAS Construction Project has defined procurements over $100k as major and subject to PO tracking and control.

The approval of the Associate Project Manager for Physics and Computing is required before a bid is solicited for a major procurement. The Associate Project Manager for Physics and Computing approves the actual contract award.

4.5 Change Management

The Change Control Process outlined in Table 4-1 is used to control changes to the Technical, Cost and Schedule Baselines. The membership of the Change Control Board (CCB) consists of the following:

Chair –Associate Project Manager for Physics and Computing

Project Manager

Deputy Project Manager for Physics and Computing

Subsystem Managers

Facilities Manager

Software Manager

Physics Manager

Project Office

Project Planning Manager

Baseline Change Proposals (BCP) for changes to the detector Technical, Cost and Schedule baselines are referred to the CCB. The following changes are required to be submitted for consideration by the Physics and Computing CCB:

- Any change that affects the interaction with ATLAS computing. Such changes also require the concurrence of the ATLAS Change Control Board.
- Any change that impacts the performance, the cost or schedule baselines within established thresholds, of the U.S. deliverables.
- Any change that requires a commitment of over $25k of the Project Research funds in any given fiscal year.

In addition to the CCB, any changes in the deliverables resulting from contemplated change control is done in consultation with the relevant principals from the International ATLAS Collaboration, mainly, but not exclusively limited to the International ATLAS Computing Coordinator. With the concurrence of the CCB, the APM declares that a change discussed will be implemented and works with the L2 managers to establish a new baseline as a result. This decision is then codified in a memo sent to file describing the action taken. The change will then result in amended Institutional MOU's and new funding ceilings are established. If necessary, any relevant software agreements or MOU's will be modified to reflect any

changes in capabilities of deliverables resulting from the change control process. The new baseline is incorporated as part of the project performance system.

4.6 Host Laboratory Oversight

As discussed earlier, the BNL Director has been charged by DOE and NSF with management oversight responsibility for the U.S. ATLAS activities, and he may delegate this responsibility to the BNL Associate Laboratory Director, High Energy and Nuclear Physics. The Associate Laboratory Director (ALD) has appointed a Project Advisory Panel (PAP) consisting of individuals outside of the U.S. ATLAS Collaboration with expertise in the technical areas relevant to the Project and the management of large projects, to assist him in carrying out his oversight responsibility. The PAP meets at least once per year, or more frequently if required, and its report to the ALD is also transmitted to the DOE/NSF Joint Oversight Group and to the U.S. ATLAS Project Manager. The ALD works with the PM to address any significant problems uncovered in a PAP review. An external technical advisory group that reports to the Project Manager is to be appointed by the Project Manager. It meets periodically to review the status of the Physics and Computing Project and makes recommendations to the Project Manager and APM.

4.7 Meetings with DOE and NSF

There are regular coordination meetings between the DOE/NSF Project Manager, the Joint Oversight Group, the ALD, and U.S. ATLAS project management personnel for problem identification, discussion of issues, and development of solutions. Written reports on the status of the U.S. ATLAS Computing Project are submitted regularly, as specified in Table 4-3.

Table 4-3: Periodic Reports to DOE and NSF

REPORT	FREQUENCY	SOURCE	RECIPIENTS
Project Status	Quarterly	U.S. ATLAS Collaboration	DOE/NSF Program/Project Staff, BNL Associate Laboratory Director, PAP, Executive Committee, Institutional Representatives

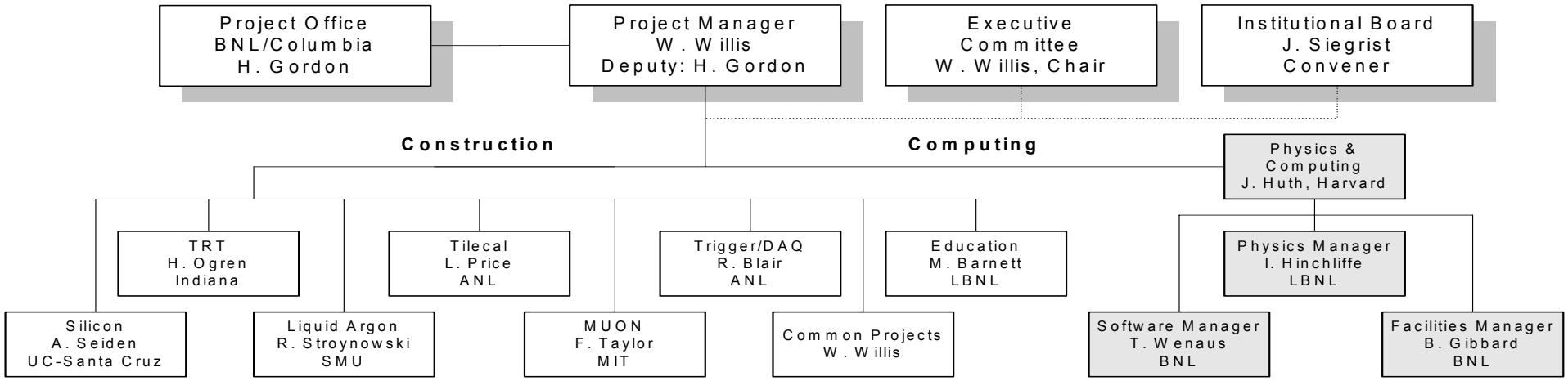
4.8 Reviews

Peer reviews, both internal and external to the Collaboration, provide a critical perspective and important means of validating designs, plans, concepts, and progress. The Project Advisory Panel, appointed by the BNL Associate Laboratory Director provides a major mechanism for project review. The PAP will have computing expertise on it, and will receive the reports of the PCAP. The DOE and NSF will set up their own Technical, Management, Cost and Schedule Review Panels to review the research, development, fabrication, assembly and management of the project. In addition, the PM and APM set up internal review committees to provide technical assessments of various U.S. ATLAS activities, as he/she considers appropriate. Normally, all review reports are made available to members of the U.S. ATLAS Collaboration. However, if a particular report contains some material that, in the opinion of the authority to which the report is addressed, is too sensitive for general dissemination, that material may be deleted and replaced by a summary for the benefit of the Collaboration.

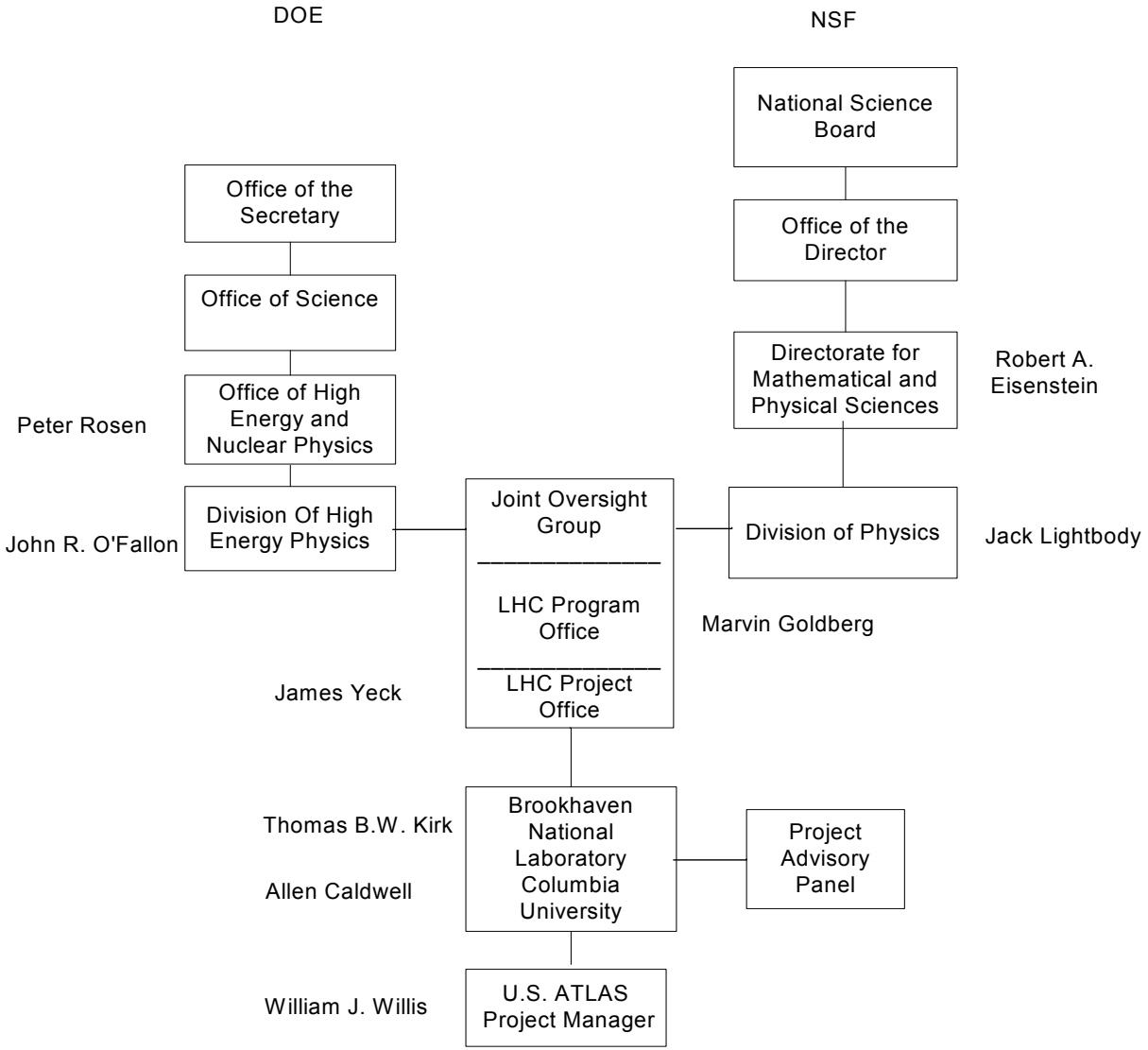
5. Review and Modification of this Project Management Plan

After its adoption, the Project Manager, the Associate Project Manager, and the Subsystem Managers as part of the preparation for reviews by the PAP periodically review this Project Management Plan. Proposals for its modification may be initiated by the PM, the APM, the Executive Committee, the BNL Associate Laboratory Director, and the funding agencies. Significant modifications to the Plan require approval of the JOG. Modifications of the Project Management Plan will require approval of the PM, the Associate Laboratory Director, the DOE/NSF Project Manager, and the U.S. ATLAS Executive Board.

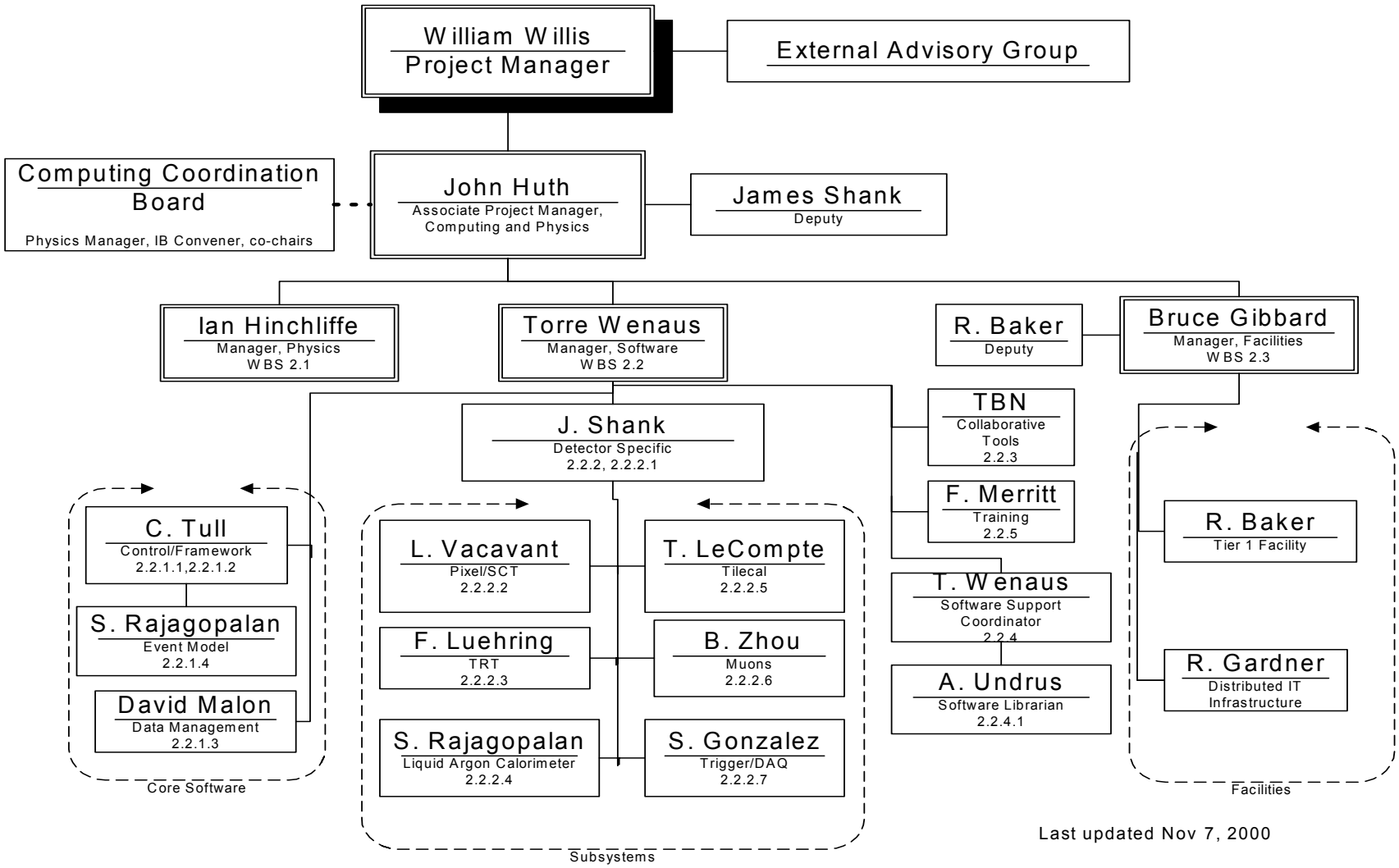
Apppendix 1: U.S. ATLAS Organization



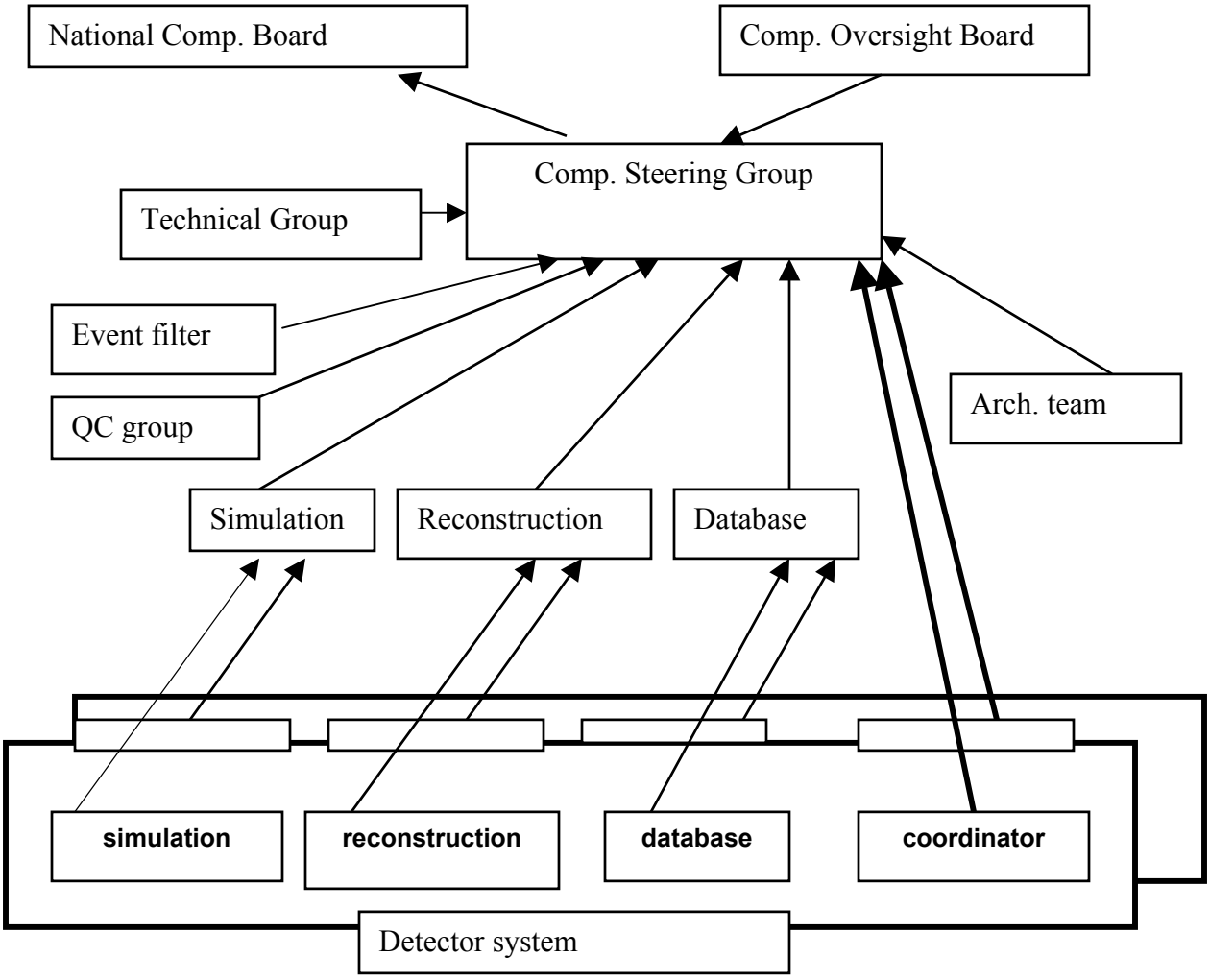
Appendix 2: DOE-NSF-U.S. ATLAS Organization



Appendix 3: Management Structure of the U.S. ATLAS Physics and Computing Project



Appendix 4: Organizational Structure of Computing and Physics in the International ATLAS Collaboration



Appendix 5: Tier 2 Selection Process

Dear Atlas Collaborator,

This letter proposes a selection process to determine the sites of the NSF funded US ATLAS Tier 2 computing facilities. We intend that this process shall be as open and objective as possible. Two sites will be chosen as research and development oriented prototype Tier 2 facilities that will play an integral role in the ATLAS MDC2 in 2003. One of these two prototype facilities will be chosen in January 2001 and the other will be chosen in April 2001. The selection process to determine the locations of the permanent US ATLAS Tier 2 facilities will begin in the second half of 2002. A decision on the locations of the five permanent facilities will be made by April 1, 2003, and funding for the permanent Tier 2 facilities will begin in FY'04. The two initial prototype centers will have the option of competing to become permanent facilities, but the proposals for all locations will be considered by the same criteria.

Prototype Tier 2 Description and Selection Process

The primary focus of the two prototype tier 2 facilities will be research and development of grid computing and validation of the ATLAS tiered computing model. The funding for these facilities and the commitment of the facilities to US ATLAS will terminate at the end of FY'03. Funding for one of these facilities is expected to begin in FY'01. The second prototype Tier 2 center will start to receive funding in FY'02, and in FY'03 both prototype facilities will be expected to participate fully in MDC2.

Candidates for selection as a prototype US ATLAS Tier 2 computing center shall be judged based on the degree to which the site their satisfies the criteria listed below. This list of criteria is not intended to be completely exhaustive, and other factors may be considered as relevant. Sites that will provide more realistic testing of the computing model in the MDC 2 time frame will be preferred.

1) The chosen site must be acceptable to the NSF. This is an absolute requirement because Tier 2 funding must be approved by the NSF. The site must consult with the NSF to determine eligibility prior to submitting a proposal.

2) The chosen site must be active in Grid research. The number of research personnel and the degree of their involvement in Grid research projects (such as GriPhyN, PPDG and Globus) will be a significant measure of the site's satisfaction of this requirement.

3) The chosen site must name a technically capable principal investigator who will devote a significant fraction of her/his time to the Tier 2 effort (as distinct from Grid research). The amount of time that the PI expects to devote should be clearly stated in the site's proposal. The principal investigator will be responsible for managing the Tier 2 facility and will contribute to the development of the US ATLAS distributed computing model.

4) The chosen site must leverage existing infrastructure and resources such as local area network, WAN connection, support staff and possibly existing hardware such as processors and disk storage. The emphasis will be on finding sites where the greatest capacity for MDC 2 activities can be achieved with the limited hardware funding that will be available.

5) The site's WAN connectivity will be considered to maximize benefit to the development of the ATLAS distributed computing model.

Any site wishing to be considered as a candidate for location of the first prototype facility should submit a letter to the Tier 1 facility managers no later than January 15, 2001 so that the site can be selected before the end of January. Sites wishing to be considered as candidates for the location of the second prototype facility must submit a letter to the Tier 1 facility managers no later than March 1, 2001. Sites that were unsuccessful in the January selection may submit amended proposals. The second prototype site will be selected by April 1, 2001. The letters submitted for either of these two prototype facilities should explain why a particular site should be selected. Letters should address the selection criteria, including details of existing or planned local resources that will be leveraged in support of the prototype facility. Proposals may also address any additional factors that the principal investigator considers relevant. Letters should also explain how the Tier 2 prototype development activity would affect Grid research and development activities at the site. The Tier 1 facility managers will review all of the requests and interview applicants as necessary. The Tier 1 facility managers will send a report to the US ATLAS Computing Coordination Board and the US ATLAS Computing Project Manager detailing the results of their review and recommending the selection of one site. The US ATLAS Computing Project Manager, in consideration of the report from the Tier 1 facility managers and any additional input from the Computing Coordination Board shall make the final decision where to locate each prototype center.

Permanent Tier 2 Facility Selection Process

The selection criteria for the permanent Tier 2 facilities will be decided by the Computing Coordination Board with input from the Tier 1 facility managers, the US ATLAS computing project manager and the principal investigators for the two prototype Tier 2 sites. These criteria will be finalized and distributed to all US ATLAS collaborators by July 2002. Proposals will be submitted by October, 2002 by all US institutions that wish to be considered as permanent Tier 2 facilities. The Computing Coordination Board will appoint a review committee to review these proposals. The review committee will read all of the proposals and follow up with visits to candidate sites as necessary to evaluate which Tier 2 sites will provide the greatest benefits to US ATLAS. The review committee will transmit a report on its findings and recommendations to the US ATLAS Computing Project Manager by March 14, 2003. The US ATLAS Computing Project Manager, in consideration of this report and any additional input from the Computing Coordination Board, will make the final decision where to locate the permanent Tier 2 centers by April 1, 2003.

Appendix 6: List of High Level Milestones

1999/1/1	Milestone	1 TByte database prototype	us 2.2.1.3
2000/5/9	Milestone	Release of Athena pre-alpha version	us 2.2.1.2
2000/9/29	Milestone	DB access from framework completed	us 2.2.1.3
2000/9/29	Milestone	Athena alpha version release	us 2.2.1.2
2000/10/30	Milestone	Geant3 DIGI data available	us 2.2.1.4
2000/12/22	Milestone	Java graphics framework fully functional	us 2.2.1.7
2000/12/22	Milestone	Inner tracker reconstruction as good as ATRECON	atlas 3.2.3
2000/12/22	Milestone	System reconstruction as good as ATRECON	us 2.2.2.10
2000/12/22	Milestone	LAr reconstruction as good as ATRECON	us 2.2.2.4.3
2000/12/22	Milestone	Reading LAr test beam from Objy into Athena possible	us 2.2.2.4.5
2000/12/22	Milestone	Tilecal reconstruction as good as ATRECON	us 2.2.2.5.4
2000/12/22	Milestone	Muon reconstruction as good as ATRECON	us 2.2.2.6.4
2000/12/22	Milestone	Electron/photon reconstruction as good as ATRECON	us 2.2.2.10.2
2000/12/22	Milestone	Jets/missing ET reconstruction as good as ATRECON	us 2.2.2.10.3
2000/12/22	Milestone	B tagging reconstruction as good as ATRECON	us 2.2.2.10.5
2000/12/22	Milestone	Global muon reconstruction as good as ATRECON	us 2.2.2.10.4
2000/12/31	Milestone	Geant3 HIT data available	us 2.2.1.4
2001/1/2	Milestone	First definition of regional centers	us 2.2.1.8.2
2001/01/26	Milestone	Athena beta release	us 2.2.1.2
2001/05/11	Milestone	Fast simulation validated	us 2.2.2.1.2
2001/5/14	Milestone	Athena gamma release	us 2.2.1.2
2001/5/14	Milestone	Database milestones coordinated with Athena gamma release	us 2.2.1.3
2001/05/31	Milestone	ARC report completed	us 2.2.1.2
2001/5/31	Milestone	Database architecture document	us 2.2.1.3.1
2001/6/29	Milestone	Decide on data base product	us 2.2.1.3
2001/6/29	Milestone	Library of generators available	atlas 3.8.1
2001/7/16	Milestone	Summer 2001 database milestones (date approximate)	us 2.2.1.3
2001/9/30	Milestone	Athena release	us 2.2.1.2
2001/9/30	Milestone	Database milestones coordinated with Athena release	us 2.2.1.3
2001/11/30	Milestone	Final assessment of Athena as T/DAQ EF framework	us 2.4.1
2001/12/12	Milestone	Mock Data Challenge 0 Completed	us 2.4.5.1
2001/12/21	Milestone	Combined reconstruction as good as ATRECON	us 2.2.2.10
2001/12/21	Milestone	Athena production version V1 release	us 2.2.1.2
2001/12/21	Milestone	Database milestones coordinated with Athena release	us 2.2.1.3
2001/12/21	Milestone	Geant4 physics validated	us 2.2.2.1.4

2001/12/21	Milestone	First major cycle of OO software completed	us 2.4.1
2001/12/21	Milestone	OO/C++ reconstruction validated	us 2.1
2001/12/21	Milestone	Computing MOU concluded	us 2.4.1
2001/12/21	Milestone	First full release of LAr OO/C++ software	us 2.2.2.4.1
2001/12/31	Milestone	Integrated and deployed distributed data service	us 2.2.1.3.17
2001/12/31	Milestone	Core software agreements complete	us 2.4.1
2001/12/31	Milestone	Full validation of Geant4 physics	us 2.2.2.1.4
2002/1/2	Milestone	Database milestones at start of Data Challenge 1	us 2.2.1.3
2002/7/30	Milestone	Mock Data Challenge 1 completed	us 2.4.5.2
2002/7/30	Milestone	Database milestones at end of Data Challenge 1	us 2.2.1.3
2002/11/29	Milestone	Computing TDR finished	us 2.4.3
2002/12/31	Milestone	Comprehensive production distributed data service deployed	us 2.2.1.3.17
2002/12/31	Milestone	10% processing farm prototype in place	us 2.2.2.1.6
2002/12/31	Milestone	100 TByte database prototype complete	us 2.2.1.3
2003/6/30	Milestone	Production remote job submission service deployed	us 2.2.1.10.4
2003/7/31	Milestone	Decide first production OS	us 2.2.2.1.6
2003/9/30	Milestone	Mock Data Challenge 2 completed	us 2.4.5.3
2003/12/22	Milestone	Second major cycle of OO software completed	us 2.4.1
2004/6/30	Milestone	Physics readiness report completed	us 2.4.4
2004/7/30	Milestone	Test full chain in real environment	us 2.2.2.1.6
2004/12/31	Milestone	Full database infrastructure available	us 2.2.1.3
2004/12/31	Milestone	40% processing farm prototype	us 2.2.2.1.6
2005/12/31	Milestone	LHC starts beam tuning	us 2.4.6
2006/4/1	Milestone	LHC pilot run starts	us 2.4.6
2006/6/30	Milestone	100% processing farm	us 2.2.2.1.6
2006/8/1	Milestone	First LHC physics run	us 2.4.6

Appendix 7: Projected Budget and FTE Profile

WBS Number	Description	Fiscal Years AY k$'s FY 02	FY 03	FY 04	FY05	FY06	Total	FY07
2	**US Atlas Computing**	**3,581**	**5,328**	**8,201**	**10,123**	**14,457**	**41,690**	**17,755**
2.1	Physics	100	147	196	210	215	868	215
2.2	Software Projects	2252	2400	3043	3446	3547	14688	3500
2.3	Computing Facilities							
2.3.1	Tier 1	839	1701	3392	4467	7575	17974	10615
2.3.2	Distributed IT	290	780	1120	1850	2970	7010	3265
2.9	Project Support	100	300	450	150	150	1150	160
	Management Reserve	0	250	820	1,012	1,446	3528	1,776
	US ATLAS Computing w/reserve	**3,581**	**5,578**	**9,021**	**11,135**	**15,903**	**45,218**	**19,531**

Budget Summary level WBS item in at year kilo dollars

WBS Number	Description	Fiscal Years FTE's FY 02	FY 03	FY 04	FY05	FY06	Total	FY07
2	**US Atlas Computing**							
2.1	Physics	0.75	1	1	1	1	4.75	1
2.2	Software Projects	12.3	11.3	13.6	14.7	14.4	66.3	13.5
2.3	Computing Facilities						0	
2.3.1	Tier 1	4.4	7	11	16	22	60.4	25
2.3.2	Distributed IT	1	2.5	6.5	11	8	29	10
2.9	Project Support	1.2	1.5	2	1.2	1.2	7.1	1

Appendix 8: Letter J. Marburger from J. O'Fallon and J. Lightbody

U.S. Department of Energy

and the

National Science Foundation

JOINT OVERSIGHT GROUP
August 12, 1999

Dr. John Marburger
Director
Brookhaven National Laboratory
P.O. Box 5000
Upton, New York 11973-5000

Dear Dr. Marburger:

The U.S. Large Hadron Collider (LHC) Construction Project is well underway. The International Agreement between the United States and the European Organization for Nuclear Research (CERN) provides that beyond the LHC Construction Project U.S. scientists participate as full partners in the LHC Research Program. The Department of Energy (DOE) and the National Science Foundation (NSF) are now considering the elements necessary for successful U.S. participation in the Research Program following the completion of the U.S. LHC Construction Project and commissioning of the facility.

The International Agreement provides that the U.S. funding agencies represent the U.S. interests with the governing bodies of CERN. This representation will be carried out primarily through the DOE/NSF Joint Oversight Group (JOG). The JOG, in turn, interacts with the U.S. collaborations to provide the funding, oversight, and infrastructure needed for the U.S. involvement. The scientific collaborations, which are responsible for the specification, design, and fabrication of the two detectors, ATLAS and CMS, will also be responsible for operation of the detectors and analysis of the physics data. The U.S. groups, U.S. ATLAS and U.S. CMS, are expected to share in these responsibilities. Due to the long lead times involved in preparing for the research program, we must act now to formalize the management arrangements for the research phase. In particular, there must be a formal management structure with clear lines of fiscal authority to support the current efforts to design and implement the software, computing, and networking that will enable U.S. physicists to be competitive in data analysis.

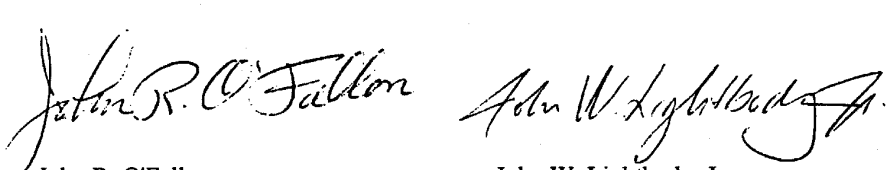
The conclusion of a series of agency reviews of directions for LHC computing is that the computing should be managed as a project with a clear management structure. The Host Laboratory model has proven to be a successful vehicle for the U.S. LHC Construction Project. Consequently, the JOG wants to use this model for the U.S. LHC Research Program, which comprises the activities necessary for participation in the operation of the ATLAS and CMS detectors and in the related physics programs. With regard to the ATLAS detector, we are asking Brookhaven National Laboratory (BNL), in addition to hosting the U.S. ATLAS Construction Project, to assume the role of Host Laboratory for the U.S. ATLAS Research Program, consistent with the International Agreement and its Detector Protocol.

Host laboratory responsibilities for the U.S. ATLAS Research Program include management oversight for U.S. ATLAS computing. It is understood that, along with management oversight for the computing project, BNL will function as the Regional Center (Tier 1) for U.S. ATLAS computing. We request that, as Host Laboratory, in concert with the U.S. ATLAS Collaboration, BNL direct the preparation of a Project Management Plan (PMP) for U.S. ATLAS software, computing and networking. This plan should recognize the software and computing initiatives already underway. Since these activities are intimately involved with the extraction of physics results, the full ATLAS Collaboration must be involved in the evolution of the PMP. The draft PMP should be submitted to the JOG for review and approval prior to implementation.

Just as the detector collaborations are embarking on a new paradigm for data analysis, the funding agencies are embarking with the U.S. LHC Research Program on a new paradigm of international cooperation. To ensure that the U.S. program is well managed and productive, we ask that you accept the Host Laboratory role outlined above for BNL, indicating your willingness by signing on the concurrence line below.

Thank you in advance for your help in continuing our successful partnership in management oversight of the U.S. LHC Program.

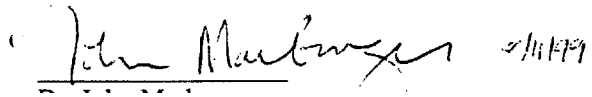
Sincerely,



John R. O'Fallon
Co-chair
Joint Oversight Group
Department of Energy

John W. Lightbody, Jr.
Co-chair
Joint Oversight Group
National Science Foundation

On behalf of the Brookhaven National Laboratory. I accept the role of Host Laboratory for the U.S. ATLAS Research Program.



Dr. John Marburger, Director
Brookhaven National Laboratory

cc:

Rodger Cashmore, CERN
Robert Eisenstein, NSF
John Huth, Harvard
Peter Jenni, CERN
Tom Kirk, BNL
Martha A. Krebs, SC-i
Luciano Maiani, CERN
George Malosh, BNL
Peter Paul, BNL

S. Peter Rosen, SC-20
William Willis, Columbia

Appendix 9: WBS

WBS Description ATLAS PBS 2 US ATLAS Physics and Computing

Manager: J.Huth

This is the overall Physics and Computing Project, which is in effect from the inception of the PMP WBS (November 2000), until the start of the LHC, expected to be in 2007, when the Project becomes part of the U.S. ATLAS research program.

2.1 Physics

Manager: I.Hinchliffe
The Physics subproject includes support of Data Challenges in the U.S., and U.S. deliverables to International ATLAS in the support of event generators.

2.1.1 Event generators
Maintenence of interfaces between generators and atlas code
Maintenance of third party software in atlas repository

2.1.2 Coordination of Data Challenges
Support of event generation, and coordinate end-user analysis efforts to utilize data generated for challenge.

2.2 ATLAS-specific Software

Manager: T.Wenaus
Development of offline software for the ATLAS experiment.

2.2.1 Common Core
Non-detector specific software efforts which are part of the core ATLAS offline computing infrastructure. The scope includes development, support (including the provision of user support) and maintenance.

2.2.2 Simulation and Reconstruction
Software for the (post-generator) simulation and reconstruction of ATLAS events.

2.2.3 Collaborative tools
Tools that allow collaboration from remote sites, including videoconferencing, electronic notebooks, grid services, etc.

2.2.4 Software support
Installation, support, and help desk for U.S. installations of ATLAS offline software. U.S. ATLAS software librarian. Tools supporting software development.

2.2.5 Training
Training of physicists, software professionals and students in software tools and methodologies, languages, ATLAS specific software packages, etc.

2.2.6 Data production

Managed production using standard offline software releases.

2.3 Facilities

Manager: B.Gibbard/R.Baker
Computing facilities, systems support, facility software and tools

2.3.1 Tier 1 Computing Facility at Brookhaven National Lab

2.3.2 Distributed IT Infrastructure

2.4 Common items

Manager: J.Huth
Items with a scope of the full ATLAS Computing and Physics Project, including project coordination and planning, and organization of major milestones.

2.4.1 Coordination and planning
ATLAS Computing Project overall coordination and planning

2.4.2 Computing model for analysis 5.2

2.4.3 Computing TDR 1.2
Preparation of the computing technical design report (end 2002)

2.4.4 'Physics TDR prime'
Physics TDR done in preparation for data taking (end 2004)

2.4.5 Data Challenges

2.4.6 Startup commissioning
Activities in support of commissioning and initial physics running of ATLAS

2.4.7 Physics operations support
Activities in support of production physics running of ATLAS

Appendix 10: Institutional Responsibilities

Institutional Responsibilities

Institution	Responsibility	Contact
ANL	Data Management	David Malon
ANL	Tilecal Reconstruction	Tom LeCompte
University of Arizona	Shielding evaluation	Mike Shupe
Boston University	Muon reconstruction	James Shank
Boston University	Grid applications	James Shank
BNL	Regional Center for U.S. ATLAS	Bruce Gibbard
BNL	Software support	Torre Wenaus
BNL	Event model	Srini Rajagopalan
BNL	Muon reconstruction	Torre Wenaus
BNL	EM Calorimeter Reconstruction	Srini Rajagopalan
BNL	Data management	Torre Wenaus
University of Chicago	Software training	Frank Merritt
University of Chicago	Tilecal Reconstruction	Frank Merritt
Columbia University	EM Calorimeter Reconstruction	Misha Leltchouk
Harvard University	Project Management	John Huth
Indiana University	Distributed IT Infrastructure	Rob Gardner
Indiana University	TRT reconstruction/simulation	Fred Luehring
LBNL	Architecture Framework	Craig Tull
LBNL	Physics support	Ian Hinchliffe
LBNL	Event Model	Paolo Califiura
UCSC	Atlantis	Alan Litke